

NISTTech

Microfluidic Apparatus to Control Liposome Formation

Creates a homogenous liposome population

Description

This invention is a method to tailor liposome size and size distribution in a microfluidic format. This method engineers liposomes by changing the flow conditions in a microfluidic channel, obviating the need for postprocessing.

A stream of lipids dissolved in alcohol is hydrodynamically focused between two sheathed aqueous streams in a microfluidic channel. The laminar flow in the microchannel enables controlled diffusive mixing at the two liquid interfaces where the lipids self-assemble into vesicles. The liposomes formed by this self-assembly process are characterized using asymmetric flow field-flow fractionation combined with quasi-elastic light scattering and multiangle laser-light scattering.

The vesicle size and size distribution are tunable over a mean diameter from 50 to 150 nm by adjusting the ratio of the alcohol-to-aqueous volumetric flow rate. Liposome formation depends more strongly on the focused alcohol stream width and its diffusive mixing with the aqueous stream than on the shear forces at the solvent-buffer interface.

Applications

- - Drug delivery
- - Transfection across nuclear membranes in gene therapy
- - Could potentially open applications for on-demand liposome-mediated delivery of point-of-care personalized therapeutics

Advantages

- - Obviates the need for postprocessing
- - Size can be controlled by adjusting the fluid flow rates
- - Reproducible flow fields for the self-assembly of lipids in the sheathed flow field

Abstract

An apparatus to create a homogenous liposome population without post-processing using laminar flow/diffusive mixing, and for reducing waste discharge of the therapeutic or compound to be encapsulated and delivered by the liposomes.

Inventors

- Gaitan, Michael
- Jahn, Andreas
- Locascio, Laurie E.
- Vreeland, Wyatt
- Reiner, Joseph E.

Citations

1. A. Jahn, W.N. Vreeland, D.L. DeVoe, L.E. Locascio, M. Gaitan, Microfluidic Directed Formation of Liposomes of Controlled Size, American Chemical Society Langmuir, 23 (11) pp 6289-6293. 2007.

References

- Application #12/762,794, filed 4/19/2010; pub #20100202928A1, 8/12/2010; Expires 4/27/2032
- Docket: 09-017

Status of Availability

This invention is available for licensing exclusively or non-exclusively in any field of use.

Last Modified: 02/11/2011